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Environmental Restoration Contractor **ERC Team**

Meeting Minutes

SUBJECT 100-D PONDS, DEMONSTRATION OF TECHNICAL BASIS FOR CLEAN CLOSURE

TO Distribution

FROM S.W. Petersen SWP

DATE November 26, 1997

ATTENDEES

C.E. Corriveau, H0-17
K.R. Fecht, H0-02
G.I. Goldberg, H0-12
C.W. Hedel, H9-03
K.K. Holliday/Ecology, B5-18
J.R. James, H0-17
S.W. Petersen, H9-03
W.W. Soper/Ecology, B5-18
J.W. Yokel/Ecology, B5-18

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Attendees

Document and Information Services H0-09

A meeting on the above subject was held on November 19, 1997, at 3350 George Washington Way, Room 2B59.

Topics Discussed

Expectations for the meeting were discussed first, with all agreeing that the issue of technical justification for clean closure of 100-D Ponds should be resolved soon. Ecology will decide on the technical merits of the modeling (inputs, assumptions, etc.) presented at this meeting in the near future, but should not be expected to render a final opinion on the topic by the end of today's meeting. Ecology requested that these minutes be included in the Administrative Record. K. Holliday is drafting a letter which will record acceptance of the technical arguments for clean closure if Ecology concurs with DOE's conclusions that 100-D Ponds should be considered clean.

S. Petersen presented data to support the position that 100-D Ponds has not contributed to contamination of the vadose or saturated zones beneath the ponds. Arguments included soil and groundwater data, and the results of geochemical modeling of reactions beneath the ponds, using the computer model PHREEQC.

The PHREEQC computer model has been in use by the U.S. Geological Survey for over 15 years, and is widely used for geochemical modeling. The user inputs the compositions of aqueous and solid media, and the program calculates the equilibrium composition and quantity of reactants. The inputs and assumptions used were discussed, and it was established that the model was not altered ("tweaked") in any way. The model predicts several solid-liquid reactions beneath the ponds, none of which involve the precipitation of significant quantities of contaminants of concern. The model results also match well with some of the known compositional changes which occur beneath the ponds, particularly changes in pH. The inputs and calculated results are detailed in the attached handouts.

There was some discussion on the differences between the present modeling effort and an older conceptual model proposed by Alexander (1993, *Groundwater Impact Assessment Report for the 100-D Ponds* [WHC-EP-0666]). The older model is strictly qualitative, and made no attempt to quantify the subsurface reactions, which was the primary purpose of the newer model presented at this meeting. The older model contained several assumptions not supported by the current data. Two of these assumptions (in italics) are:

1. *The coal ash is the source of heavy metals.* This is unlikely, as TCLP results for the coal ash show very low values for heavy metals. The 100-D Ponds influent was nearly neutral in pH, which would result in even less leaching of the ash and lower metal concentrations than those determined in a TCLP analysis.

2. *The ash/Ringold interface is a geochemical "trap" which may precipitate heavy metals.* As with the postulation above, this concept was not supported in any way by data. Results of the geochemical modeling presented today do not indicate that conditions are right for wholesale precipitation of metals below 100-D Ponds.

Decisions Made

Ecology made no decisions regarding the validity of the modeling approach to 100-D Ponds, but committed to internally resolve this issue soon. K. Holliday suggested that a similar modeling effort be conducted (or combined with the present model) in support of eventual closeout of the ash pit, 126-D-1.

Action Items

Ecology will send a letter to DOE regarding clean closure of 100-D Ponds. **K. Holliday**

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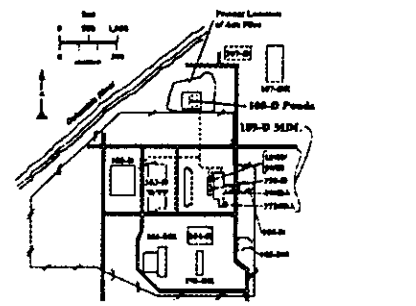
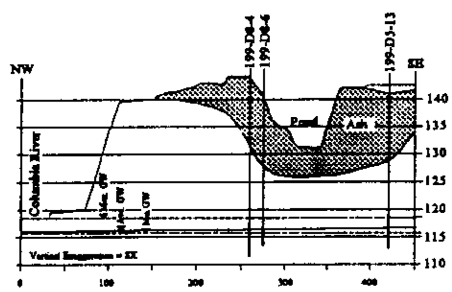
Demonstration of Technical Basis for Clean Closure **100-D Ponds**

- Overview of the Ponds
- Chemical Characteristics (soil & groundwater)
- Verification Data
- Groundwater Data
- Geochemical Modeling Data

Location of 100-D Ponds



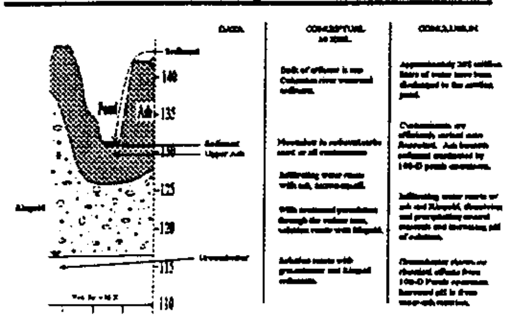
Cross-section of the Ponds



Process History

- Located in preexisting coal ash basin
- Two ponds: percolation and settling
- Primarily received effluent from the 183-D Water Treatment Facility
- D-Area laboratories contributed corrosive chemicals from demineralizer regeneration
- Unrecorded discharges of shop chemicals, mercury, and radionuclides indicated from characterization data

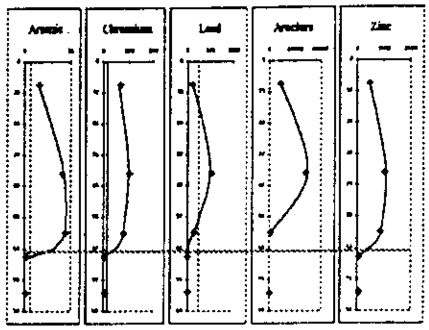
The Big Picture



Pre-removal Characterization

- Two sampling phases (1992 & 1995) of sediment and underlying ash showed elevated levels of
  - PCBs
  - Metals (arsenic, barium, cadmium, chromium, lead, mercury, nickel, vanadium, zinc)
  - Radionuclides (^{60}Co, ^{137}Cs, ^{238}U)
- High values only found in top ~60 cm of settling pond

Summary of Characterization Data



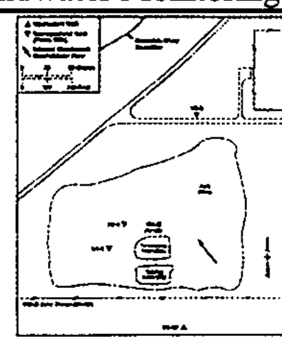
Voluntary Cleanup of Ponds

- August, 1996
- Removed 530 m^3 of sediment (alum and silt)
- Average depth of 50 cm
- Disposed of in the 200 Area Burial Grounds

Verification Sampling

- 19 Verification samples were collected, guided by DQO & SAP developed with Ecology
- Collected from bottom and sides of both Settling Pond and Percolation Pond
- Ecology analyzed splits and independent samples
- All samples collected approximately 30 cm beneath surface
- Sample set passed MTCA compliance tests

Groundwater Monitoring Network

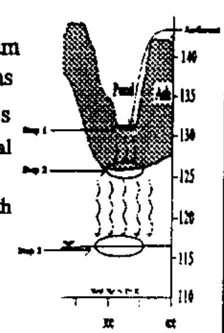


Groundwater Monitoring

- For downgradient wells:
  - Most constituents at detection limits
  - pH is high in 2 downgradient wells
  - No contaminants of concern greater than MTCA B groundwater cleanup levels
- Upgradient well is being influenced by dissipation of groundwater mound
  - elevated chromium, tritium, nitrate

Geochemical Modeling

- PHREEQC, a USGS geochemical modeling program for aqueous and solid reactions
- Modeling performed in 3 steps
  1. react infiltrating water with coal ash
  2. equilibrate reacted solution with Ringold Fm.
  3. react resulting solution with groundwater (in equilibrium with Ringold Fm.)



Step 1. React infiltrating water with coal ash

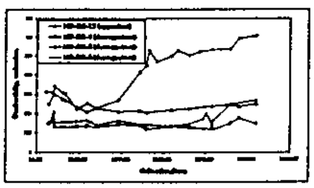
- Composition of infiltrating water
  - Columbia River water for major elements
  - TCLP values for Ba, Cd, Cr, Hg, Pb, Sb, V, Zn
- Composition of ash
  - mineral phases determined from the literature
  - anhydrite, quartz, hematite, portlandite ($CaSO_4$) (SiO_2) (Fe_2O_3) ($Ca(OH)_2$)

Step 2. Equilibrate reacted solution with Ringold Fm.

- Quartz, SiO_2
- Plagioclase feldspar, Ca-Na aluminosilicate
- Calcite, $CaCO_3$
- Montmorillonite, a clay mineral
  $(Al,Mg)_8(Si_4O_{10})(OH)_{12}\cdot 12H_2O$

Step 3. React with groundwater in equilibrium with Ringold Fm.

- Groundwater composition from upgradient well 199-D5-13
- Average of pre-1994 analyses



Geochemical Modeling Results

- Step 1: portlandite+ quartz+anhydrite sepiolite + $Ba_3(AsO_4)_2$+hematite →
  - Solution: increase Ca, S, Si, pH; decrease Fe,Mg
- Step 2: albite+calcite+montmorillonite → anorthite+quartz
  - Solution: increase Al, Fe, Mg, Na
- Step 3: quartz+boehmite+hematite → montmorillonite+anorthite+calcite+albite+ $Ba_3(AsO_4)_2$)
  - Solution: decrease pH, Fe, Mg, Na, S

Conclusions

- Near-surface ash shows no evidence of contamination remaining after removal action
- Groundwater shows no evidence of adverse impact from the operation of 100-D Ponds
- Geochemical modeling does not indicate favorable conditions for precipitation of contaminants at depth

Discussion

- Metal contamination in 100-D Pond sediments likely in flocculent used in water treatment facility (WTF)
- Flocculent trapped metals in WTF and also served to sorb metals released from process sewer into the settling pond
- No remnants of contamination front seen in upper part of ash

Summary of Modeling Results

Element	Beginning Solution Col. R. water + TCLP*	React w/ ash	React w/ Ringold	Well D5-13	Mix 10% Ringold, 90% Upgradient	React Mix w/ Ringold Resulting Sol'n	Downgradient Wells Average	
Al	0.00128	3.28E-26	9.90E-02	8.10E-02	8.28E-02	2.51E-01	0.26	
HCO3				7.65E+01			49.48	
As	0.1	8.92E-02	8.92E-02	4.30E-03	1.28E-02	1.29E-08	0.00	
Ba	0.03	6.46E-07	6.46E-07	8.00E-02	7.20E-02	3.69E-02	0.03	
Ca	21.25	5.60E+03	5.57E+03	4.37E+01	5.96E+02	2.18E+02	25.46	
Cd	0.005	5.00E-03	5.00E-03	6.70E-03	6.53E-03	6.53E-03	0	
Cl	1	1.00E+00	1.00E+00	1.18E+01	1.07E+01	1.07E+01	3.31	
Cr	0.015	1.50E-02	1.50E-02	7.50E-02	6.91E-02	6.90E-02	0.06	
F	0.1	1.00E-01	1.00E-01	2.93E-01	2.74E-01	2.74E-01	0.19	
Fe	0.035	7.84E-07	1.19E-03	2.52E-01	2.27E-01	1.49E-09	0.60	
Hg	0.0002	2.00E-04	2.00E-04	2.00E-04	2.00E-04	2.00E-04	0.00	
K	1.1	1.10E+00	1.10E+00	3.56E+00	3.32E+00	3.31E+00	3.00	
Mg	5.1	7.20E-06	1.14E-03	1.11E+02	9.99E+01	5.64E-09	3.50	
N	0.2	2.00E-01	2.00E-01	2.34E+01	2.11E+01	2.11E+01	2.03	
Na	2.15	2.15E+00	3.84E+01	5.66E+00	8.93E+00	8.86E+00	4.29	
Pb	0.1	1.00E-01	1.00E-01	5.00E-03	1.45E-02	7.83E-04	0.00	
S	11	2.81E+02	2.81E+02	1.76E+01	4.39E+01	4.39E+01	22.86	
Sb	0.032	3.20E-02	3.20E-02	0.00E+00	3.20E-03	3.20E-03	0.06	
Si	17.8	3.46E+03	3.46E+03	5.21E+00	3.50E+02	2.88E+00		
V	0.002	2.00E-03	2.00E-03	0.00E+00	2.00E-04	2.00E-03	0.011	
Zn	0.001	1.00E-03	1.00E-03	1.56E-02	1.42E-02	1.41E-02	0.008	
pH=	8.6	1.23E+01	1.23E+01	7.98E+00	1.19E+01	9.66E+00	8.46	
		mg/kg		mg/kg			mg/kg	
recipitate:	Ca-nontronite	0.06	Anorthite	218.6		Ba3(AsO4)2	0.059	
	Ba3(AsO4)2	0.05	Quartz	187.0		Anorthite	2316	
	Hematite	0.03				Albite	0.53	
	Sepiolite(c)	32.20				Calcite	110	
						Montmorillonite	3147	
						Pb(OH)2(C)	0.016	
Reactant:	Anhydrite	0.01	Albite	413.1		Hematite	148.6	
	Portlandite	0.13	Calcite	0.45		Quartz	2198	
	Quartz	0.12	Montmorillonite	0.04		Boehmite	1869	
	* Average TCLP analyses of sediments for Ba, Cd, Cr, Hg, Pbh, Sb, V, and Zn							

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